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Thomas J. Lewman (Ed.)
BDM Corporation

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In February of 1985, the BDM Corporation was contracted by the Army Research Institute (ARI) to conduct a three-year research effort in support of ARI's mission as primary research agency for the Army at the National Training Center (NTC). Performance of this contract required that BDM successfully complete seventeen tasks over the three years of the contract. Work was performed on site at ARI Presidio of Monterey (ARI-POM). This document, the final report for the contract, describes the results achieved during the contract, and provides a list of the products delivered.

Fifty-three products or reports were produced during the contract period. These fell into three major areas of endeavor: standardize (to enhance data quality), structure (to enhance data accessibility), and analyze (to enhance data interpretation). BDM's accomplishments are discussed in terms of the three outcome areas: data quality, data accessibility, and data interpretation. The final section of the report provides a brief summary of activities and a product list per individual contract task. Also presented for each task, is a description of how the contract products have been utilized.

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Research Note

FINAL REPORT FOR CONTRACT NO. MDA903-85-C-0472

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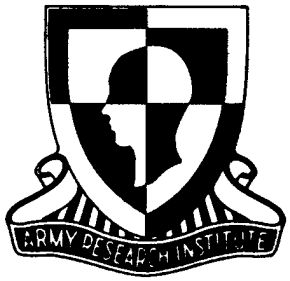

August 25, 1988

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FINAL REPORT FOR CONTRACT NO. MDA903-85-C-0472

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INTRODUCTION

In February of 1985, The BDM Corporation was contracted by the Army Research Institute (ARI) to conduct a three-year research effort in support of ARI's mission as primary research agency for the Army at the National Training Center (NTC). Performance of this contract required that BDM successfully complete five tasks in each of the three years of the contract. As a result of a contract modification, the number of tasks in the second and third years was increased to six per year. Work was performed on site at ARI Presidio of Monterey (ARI-POM).

The purpose of this document is:

1. to provide a description of the results achieved during the contract; and

2. to provide a list of the products delivered under this contract.

There were three primary thrusts to this effort: standardize (to enhance data quality), structure (to enhance data accessibility), and analyze (to enhance data interpretation). After a brief overview, the discussion of BDM's accomplishments centers around the three outcome areas: data quality, data accessibility, and data interpretation. The final section summarizes the activities and lists the products per contract task.

OVERVIEW OF CONTRACT EFFORT

To facilitate an understanding of the products and activities undertaken, it is important to understand that there were three primary thrusts to the contract effort:

1. To standardize the data collection procedures at the NTC, thus improving the quality of the data derived from the NTC;

2. To structure the data from the NTC to make it more accessible to support research and lessons learned;

3. To analyze and interpret NTC data to produce products and reports, as well as to establish methodologies for future application to NTC data.

The contract work efforts were structured and performed to maximize the benefit to be accrued by both sets of Army proponents, the scientific community and the military community. Each step of the research process was used to generate results that satisfied both proponent communities. This is represented in Figure 2.1.

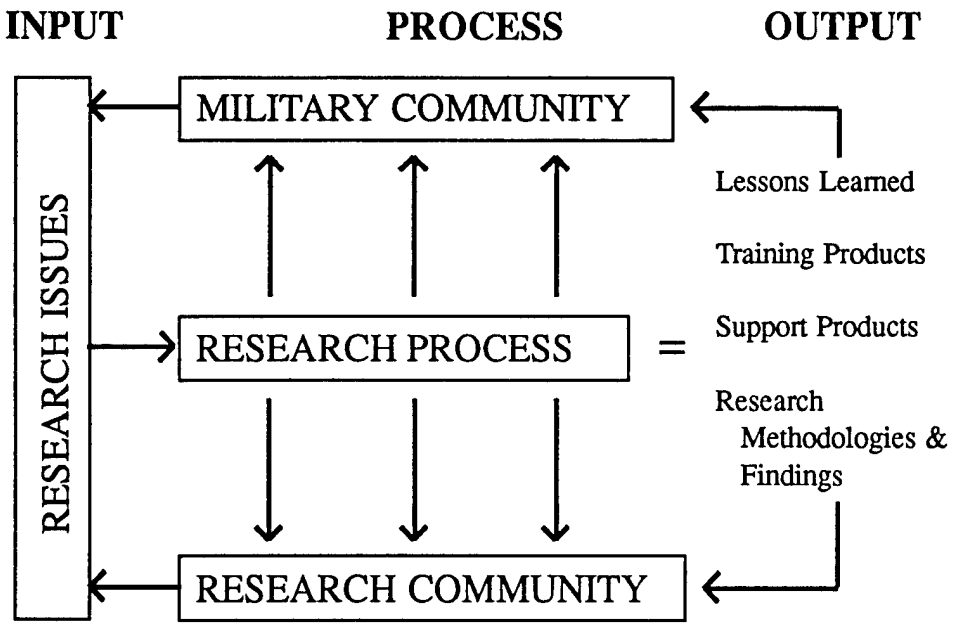

Figure 2.1 The research process systems model

The basic approach taken by BDM in conducting work was to follow the flow of logic as illustrated in Figure 2.2.

In 1985, many of the procedures and operations for conducting a training rotation at the NTC were undocumented, highly variable, and shifted considerably with changes in the change of command. Perhaps even more importantly, assessment of unit performance was unsystematic and largely subjective, based on anecdotal accounts of the Observer/Controllers (O/Cs). BDM undertook several efforts to contribute to greater standardization including manuals for DeAnza Workstation Operators and guidebooks for O/Cs. However the largest part of the effort to standardize centered on the development of a system for measuring and viewing unit performance at the NTC. This system, described below, has come to be known throughout the Army as "2A".

In 1985, digital data and other training information emerging over the course of NTC rotations were largely unusable from a research perspective. The database was unwieldy and difficult to use, and contained large amounts of missing and redundant data. As part of the contract effort, BDM developed a fully operational, fully documented database containing all NTC missions since 1986. BDM also helped ARI develop workshops whereby prospective NTC database users are trained and certified to access the information in the database.

With the development of a usable research database, ARI's capability to address targeted issues was expanded. BDM has participated in numerous analyses to support the NTC Lessons Learned research program administered by the Center for Army Lessons Learned (CALL), as well as analyses to develop concepts and methods such as trendline analysis.

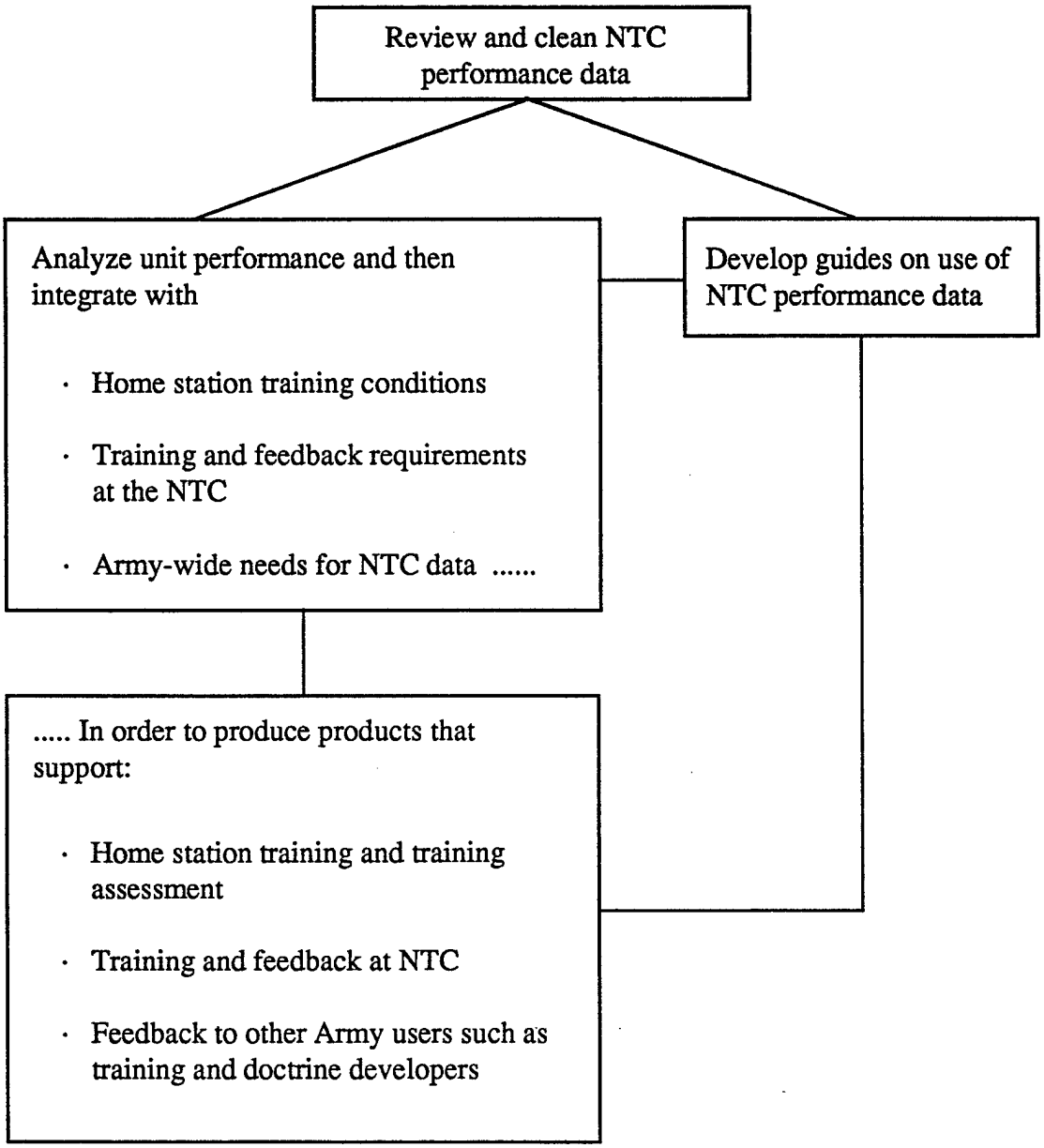

Figure 2.2 Approach to execution of contract

A more detailed presentation of accomplishments and products is now presented for data quality, data accessibility, and data interpretation.

Data Quality

BDM approached the data quality issue with the objective of developing a framework to serve as a data collection and analysis instrument that would offer a meaningful insight into systemic issues as they impact on the tactical employment of maneuver units.

Task 2A mandated the development of a system of data collection that could be utilized for immediate tactical training requirements and long term research. Specifically, this system had two requirements. The first requirement was that the system have field utilization for rapid feedback of tactical events at the NTC. Secondly, the system was to be designated for use by research and military agencies in framing and analyzing a variety of tactical systemic issues from training to synchronization.

The product developed by BDM to address these requirements is officially entitled the Unit Performance Measurement System, commonly referred to as 2A. It was developed in two major parts: The Unit Effectiveness Measurement System and the Critical Task Measurement System.

The Unit Effectiveness Measurement System (UEMS) is designed to give an outcome assessment to a specific mission. Structured against the factors of METT-T (Mission, Enemy forces, Friendly forces, Terrain, and Time), it assigns an attribute of condition, purpose, and standard to each factor according to the respective mission. Although the UEMS was designed specifically for the battalion task force level, its structure is flexible enough for use at all echelons up to brigade level.

The Critical Task Measurement System (CTMS) is designed to assess a unit conducting a tactical mission through the use of mission critical tasks. These tasks, which are grouped within an echelon and mission specific framework, are organized both sequentially and functionally to reflect the pattern of activity during a mission. This task layout facilitates diagnosis of why a respective unit did, or did not, do well on a particular mission. Mission books were developed for platoon, company/team, and task force echelons covering five mission types:

1. Defend,
2. Deliberate Attack (Day),
3. Deliberate Attack (Night),
4. Movement to Contact, and
5. Hasty Attack.

Critical tasks were defined for each of the five mission types by echelon. Some tasks were applicable to more than one mission type while others were applicable to only one. Conditions were derived from an in-depth analysis of the METT-T factors using the NTC environment as the setting for this study. These conditions were provided for each mission type and its phase and battle segment. Standards of performance, in terms of measurable outcomes, were also provided for

each mission type. A criterion measurement was then provided for each critical task.

In summary, 2A was designed to serve as a data collection instrument, an immediate mission feedback mechanism, and a data analysis structure. It also can facilitate identification of tactical training requirements, operational trends, and systemic issues requiring resolution. These aspects of the system serve to enhance the effectiveness of the Combat Training Centers and tactical training within maneuver battalions throughout the Army.

Data Accessibility

Much of the effort expended during the previous contract was aimed at providing ARI and the Army access to data from the NTC. The three year effort provided a number of products devoted to this goal.

The initial period of the contract, covering approximately 18 months, was dedicated to examination of the NTC range data collection systems and the existing research database system vis a vis the research requirements of ARI and the Army. A requirement for more effective user documentation for NTC and research personnel, who were called upon to use the De Anza workstations, was identified and satisfied. A concentrated investigation into the format and character of the NTC data was conducted, resulting in detailed documentation of the two NTC digital data sources, the log tapes from the Range Data Measurement Subsystem (RDMS) and files from the Core Instrumentation Subsystem (CIS).

The next major step in enhancing the accessibility of NTC data was the design of an improved research database system. It became apparent from the activities mentioned above that a redesign was necessary for several reasons:

1. The original design was inefficient, in that a great deal of redundant information was present in several tables;

2. The redundancy caused the databases to be inordinately wasteful of disk space, limiting the number of databases that could be maintained online at any particular time; and

3. The process required to build the databases was unwieldy, yet provided little or no opportunity to control the scope of the databases that were built.

The database development effort was initiated by defining an approach that would culminate in a database system that supported the requirements of the Army and ARI. The next step was the publication of a draft 'strawman' preliminary design. This strawman was distributed to all potential users of the NTC data which had been identified at that time. Comments and suggestions were considered and incorporated via a modified Delphi technique into the final revision of the basic design, and development commenced. The database building software was completed in May, 1987, at which time BDM began to build mission databases.

Subsequent to the availability of the redesigned ARI-POM Database Management System, a need was identified by the TRADOC commander to make use of the historical NTC data to generate trendline analyses in support of the Center for Army Lessons Learned (CALL). Soon afterward, the commanders of the Army schools were urged to 'get smart' about the NTC data available for analysis. Accordingly, a series of workshops were conducted by ARI-POM to prepare delegates from the Army school system to make use of the NTC data. BDM participated in the design and conduct of these week-long training sessions. In addition to the courseware developed to hold the series of workshops, a guide was developed to using the ARI-POM research database.

Data Interpretation

In addition to enhancing the accessibility and quality of the NTC data, BDM has been committed to the large-scale effort involving the interpretation of training data. This commitment to ARI programmatic research is illustrated by a wide array of BDM research reports and products generated during the contract period. The research conducted represent three similar, yet distinct, types: methodological research intended to establish appropriate means for modeling and analyzing training data; research reports providing analytical support to CALL on high-priority training issues; and, highly-specialized applied research products that are adopted for use within the Army training environment.

The purpose of methodological research is to develop concepts and methods for measurement, interpretation, and feedback of CTC data. Some of the specific objectives accomplished during the contract were to develop concepts and methods for measurement and interpretation of unit performance at the NTC, develop concepts for trendline analysis, and develop an integrated framework for CTC research.

The purpose of the NTC Lessons Learned research program is to provide analytical support to CALL high-priority issues. The Lessons Learned research efforts were directed by CALL as a result of heightened interest in particular phenomena occurring during NTC training. Research findings often resulted in the designation of focused rotations at the NTC or further study of related issues. During the course of the three-year contract, several Lessons Learned reports were produced. Lessons Learned analyses included the use of instrumented data, Take Home Packages (THPs), After Action Review (AAR) video tapes, doctrinal manuals, and data displays developed by BDM at ARI-POM. Lessons Learned findings were presented as reports, briefings, or as contributions to larger-scale efforts being conducted by CALL.

The third category of research conducted by ARI/BDM involves the production of applied research products that are used for Army training purposes. Observer/ Controller Guidebooks, developed jointly by ARI and BDM are currently being used by the observer/ controllers at the NTC. A training video tape was developed to demonstrate how NTC data can be optimally used for training combat leaders. The video is composed of training vignettes which are composed of De Anza workstation battle graphics, portions of communications tapes, and AAR segments that are designed to illustrate critical points occurring in actual NTC battle segments.

In summary, BDM has supported efforts encompassing the many aspects of ARI's programmatic training research.

CONTRACT TASK SUMMARIES

The final section of this report provides a brief summary of activities and a product list per individual contract task. Also presented for each task is a description of how the contract products have been utilized. The contract tasks are grouped by year of the contract (1 through 3). The structure of the contract was such that the output from each year's effort was designed to feed directly into the conduct of the next year's tasks. Tasks 1 through 5 were accomplished during Year One; Tasks 6 through 10, during Year Two; and Tasks 11 through 15 during Year 3. Task 2A, a task added through a contract modification, was designed to be accomplished during years 2 and 3. Year Three was 18 months long, due to an extension through August 1988.

The deliverables are presented under the contract year heading in which the work was performed and the product delivered; in some cases the ARI publication date for a deliverable may correspond to a later contract year. No report number is listed for documents which are not yet final ARI publications.

Contract Year One
(Tasks 1 through 5)

Task 1

Develop and Apply Procedures for Identification and Correction of Erroneous Data from NTC

Summary

This task had as its central concern the investigation of the quality of the digital data from the NTC. As part of this effort, several comparisons were undertaken to determine the relative accuracy of varying data sources.

Products/Reports

Briscoe, J.A. (1987, January). Capability to analyze National Training Center data (ARI Research Note 87-08). Alexandria, VA: U.S. Army Research Institute. [DTIC # ADA178948]

Briscoe, J.A. (1987, January). Comparison of National Training Center data sources (ARI Research Note 87-12). Alexandria, VA: U.S. Army Research Institute. [DTIC # ADA179797]

Briscoe, J.A. (1987, January). Program GDETAP documentation (ARI Research Note 87-09). Alexandria, VA: U.S. Army Research Institute. [DTIC # ADA179892]

Kemper, T. R., & Briscoe, J.A. (1987, January). National Training Center Data Library (ARI Research Note 87-07). Alexandria, VA: U. S. Army Research Institute. [DTIC # ADA178947]

Utilization

The products produced under this task have been used to guide research efforts and to document computer code. They have also provided the information needed for informed decision-making regarding expansion and improvement of the NTC data archive at ARI-POM. The document entitled "Capability to Analyze National Training Center Data" was used as a source document by researchers to guide their research efforts. It was also used as a jumping-off point to design improvements in the ARI-NTC data base design effort. The document entitled "Comparison of National Training Center Data Sources" defined the similarities and differences between the two major instrumented NTC data archives. It served as the basis for the decision to begin archiving RDMS tapes at ARI-POM, and to include RDMS data in the mission databases. "Program GDETAP Documentation" documents the code used to read the NTC RDMS tapes and to produce the three standard reports. The document entitled "National Training Center Data Library" served as a basis to expand and improve the storage of NTC data at ARI-POM.

Task 2

Develop and Apply Concepts and Methods for Measurement and Interpretation of Unit Performance

Summary

Defining and measuring battalion combat effectiveness was the central issue for this task. Preliminary analyses of live-fire performance, force-on-force performance, and relative performance of BFVs and M113s were prepared to demonstrate the utility of NTC data for describing combat performance. At the same time a concept and methodology were developed for a systems approach to measuring combat performance. A contract modification was prepared to permit development of the proposed system for all NTC missions rather than the prototype mission originally called for in the contract. This task is described under contract years 2 and 3 and is entitled Task 2A.

Products/Reports

Forsythe, T. K. (1987, January). A research concept for developing and applying methods for measurement and interpretation of unit performance at the NTC (ARI Research Report 1435). Alexandria, VA: U.S. Army Research Institute.

Ritenour, T. J. (1987, January). National Training Center research issues (ARI Research Note 87-06) Alexandria, VA: U.S. Army Research Institute.

Doherty, W. J., & Hiller, J. H. (1986, January). Comparison of the BFVs and M113 equipped battalion task forces on live fire performance at the NTC (ARI Special Report). Presidio of Monterey, CA: U.S. Army Research Institute Field Unit.

Forsythe, T. K., & Doherty, W.J. (1987, April). An NTC live fire performance analysis (ARI Research Note 87-21). Alexandria, VA: U.S. Army Research Institute. [DTIC # ADA188247]

Nichols, J. J. (1987, February). A preliminary analysis of NTC force-on-force performance (ARI Research Note 87-14). Alexandria, VA: U.S. Army Research Institute. [DTIC # ADA180287]

Utilization

Concepts developed in these efforts were used to generate the initial empirical results from the NTC. Specifically, the reports on live fire performance and force-on-force performance were the first empirically based results from the NTC provided to CALL. The report on the BFVs provided input to the Army's response to congressional queries concerning BFV effectiveness. The Forsythe report provided the initial systems concept that led to the work performed under Task 2A of this contract.

Task 3

Develop Guides to the Use of NTC Information

Summary

Work on this task followed two different research strands. One strand led to the creation and production of a prototype document entitled "Lessons from NTC." The other strand was concerned with the preparation of guides for use with the NTC instrumentation system.

Products/Reports

Ritenour, T. J. (1987, January) A detailed description of the National Training Center instrumentation system initialization procedure (ARI Research Note 87-03). Alexandria, VA: U.S. Army Research Institute. [DTIC # ADA179860]

Nichols, J. J. (1987, January). The De Anza primer: a basic introduction to the De Anza graphics display (ARI Research Note 87-01). Alexandria, VA: U.S. Army Research Institute. [DTIC # ADA179798]

Avant, T. L., & Henderson, R. S. (1986, July) Documentation for 'What Now, Captain?': a training concept for exporting Lessons Learned from the National Training Center (ARI Research Note 87-13). Alexandria, VA: U.S. Army Research Institute. [DTIC # ADA179991]

Shackelford, W. L. (1987, January). A Method of analysis for the Bradley Fighting Vehicle System (ARI Research Note 87-10). Alexandria, VA: U.S. Army Research Institute.

Shackelford, W. L. (1985, November). Lessons from the NTC (ARI Research Report). Presidio of Monterey, CA: U.S. Army Research Institute Field Unit.

Utilization

The work performed on the NTC instrumentation system and the DeAnza workstation were both aimed at assisting the NTC Operations Group in its internal training program. Further, both provided documentation that were incorporated into system documentation at the NTC. The remaining work provided specific examples of applications of NTC data for high priority Army issues. The "What Now, Captain?" concept provided the first example of how to bring the lessons from the NTC into the classroom. The "Lessons from the NTC" provided the first comprehensive view of military lessons from a tactical expert's perspective.

Task 4

Determine Requirements for More Effective Integration of NTC and Home Station Training

Summary

By capitalizing on the measurement system developed in Task 2 and the result from "Lessons from NTC," the effort undertaken in this task provided input into Home Station Training factors related to NTC performance.

Products/Reports

Kerins, J. W., Forsythe, T. K., & Avant, T. L. (1987, January). Research plan for the evaluation of the requirements for the effective integration of the National Training Center and Home Station Training (ARI Research Note 87-11). Alexandria, VA: U.S. Army Research Institute. [DTIC # ADA179893]

Utilization

This report provided a blueprint for an approach to researching the systematic link between home station and NTC performance. Much of this approach has been included in the ongoing ARI effort directed at Determinants of Combat Effectiveness.

Task 5

Prepare Proposed Research Plan for Year 2

Summary

As per contract requirement, a research plan was prepared which incorporated Year One results along with the originally proposed plans for conduct of Year Two. This plan was originally entitled Proposed Research Plan for Year Two of the Contract.

Products/Reports

Doherty, W. J. (Ed.) (1987, February). Methodology development for deriving lessons learned from the National Training Center: Progress and future directions (ARI Research Note 87-16). Alexandria, VA: U. S. Army Research Institute. [DTIC # ADA180026]

Contract Year Two
(Tasks 2A, 6 through 10)

Task 2A (CY Two)

Develop Concepts and Methods for the Measurement and Interpretation of Unit Performance

Summary

This task represented an expansion and continuation of Task 2 above. It involved two central activities: the creation of a criterion measurement system for determining combat effectiveness at the NTC and the identification and measurement of critical tasks at the NTC.

Products/Reports

Lewman, T. J. (1987, May). Mission critical tasks at the National Training Center (ARI Research Product). Presidio of Monterey, CA: U.S. Army Research Institute Field Unit.

Root, J. T., & Zimmerman, R. A. (1988, August). A unit effectiveness measurement system at the National Training Center (ARI Research Product). Presidio of Monterey, CA: U.S. Army Research Institute Field Unit.

Utilization

Critical task lists for the task force, company/team, and platoon have been integrated into Infantry and Armor Mission Training Plans. The mission critical tasks were used as the basis for further development of the Critical Task Measurement System (CTMS). The Unit Effectiveness Measurement System (UEMS) provides the means to assess task force mission performance for those units training at the NTC. These data are used by the Army for analyzing training performance trends.

Task 6

Analyze Unit Performance

Summary

This task had as its major focus the design and creation of a research database for NTC data at the ARI Presidio of Monterey (POM) facility. Guides to the use of the database were developed as part of this effort.

Products/Reports

Briscoe, J. A. (1987, December). ARI-POM database development plan (ARI Research Note 87-74. Alexandria, VA: U.S. Army Research Institute. [DTIC # ADA190586]

Briscoe, J. A., & Baldwin, J. D. (1987, April). NTC tactical database preliminary design (ARI Research Note 87-75). Alexandria, VA: U.S. Army Research Institute. [DTIC # ADA190585]

Briscoe, J. A. & Baldwin, J. D. (1987, March) Programmer's guide to data from the National Training Center (ARI Research Product). Presidio of Monterey, CA: U.S. Army Research Institute Field Unit.

Utilization

The"ARI-POM Database Development Plan" laid out the steps in the development of the NTC mission database system, and was used as a basis for that development effort. The document entitled "NTC Tactical Database Preliminary Design" laid out the proposed table formats for the NTC mission databases and was later upgraded to reflect the implemented versions. It has been used extensively by personnel who have used the research database system as a road map to the system. It has been included as part of the NTC data workshops since their inception. The "Programmer's Guide to data from the National Training Center" has been widely used by researchers and others interested in NTC data for understanding which data elements are collected by the NTC instrumentation system, how often they are collected, and how they are organized.

Task 7

Develop Products to Support Training and Feedback at the NTC

Summary

The primary focus of this task was the design and development of guidelines for the After Action Review (AAR) tapes and the Take Home Packages (THP) at the NTC. To accomplish this, the effort addressed the exploitation of the advanced automation capabilities of the NTC and ARI-POM such as the content and format of these feedback devices.

Products/Reports

Nichols, J. J. (1987, March). NTC Take Home Package: 1982-1986 (ARI Research Report). Presidio of Monterey, CA: U.S. Army Research Institute Field Unit.

Rachford, D. L., Twohig, P. T., & Zimmerman, R. A. (1986, December). The platoon leader - platoon sergeant relationship in a tactical environment: focused rotation at the National Training Center (NTC) (ARI LMTA Working Paper 86-06). [Leadership & Management Technical Area] Alexandria, VA: U.S. Army Research Institute.

Zimmerman, D. C., & Kemper, T. R. (1987, April). The NTC After Action Review: implications for effective training feedback (ARI Research Report). Presidio of Monterey, CA: U.S. Army Research Institute Field Unit.

Utilization

The examination of NTC After Action Reviews and Take Home Packages served to provide CATA and NTC officials with information about the quality and format of these feedback tools. Implications from these studies is available to training coordinators to improve the manner in which these feedback mechanisms are prepared and presented so as to maximize their effectiveness in the overall training and learning experiences of soldiers training at the NTC.

The study of platoon leader and platoon sergeant interaction was conducted in support of an NTC focused rotation on NCO leadership. The findings from this study were used by CATA to produce Lessons Learned material that appeared in a CALL Lessons Learned publication highlighting platoon leader and sergeant interaction. The study's finding were also used as a basis for further ARI research on leadership at the NTC.

Task 8

Develop Products to Support Home Station Training and Training Assessment

Summary

This task involved the development of data collection instruments and techniques for use in describing Home Station Training. The instruments and techniques drew upon the measurement system being developed in Task 2A and upon a schema of the Army Training Process created as part of this task.

Products/Reports

Forsythe, T. K., & Avant, T. L. (1987, July). Methodology development for investigating effective NTC and home station training integration (ARI Working Paper). Presidio of Monterey, CA: U.S. Army Research Institute Field Unit.

Utilization

This effort operationalized much of the effort outlined in Task 4 and produced specific data collection approaches, instruments, and schedules. All of these were linked through the 2A measurement system and have influenced the important ARI effort directed at Determinants of Combat Effectiveness.

Task 9

Develop Products to Support Feedback to Army Users and Army-Wide Utilization of the Products of the Research

Summary

This task was concerned with dissemination of NTC information to the Army at large. Several Lessons Learned issues selected by CATA were investigated.

Products/Reports

Doherty, W. J., & Atwood, N. K. (1987, February). Killer tank crews at the National Training Center (ARI Working Paper). Presidio of Monterey, CA: U.S. Army Research Institute Field Unit.

Ritenour, T. J. (1986, March). A report of battalion task force demonstrated strengths and weaknesses during conduct of NTC simulated combat training (ARI Research Report). Presidio of Monterey, CA: U.S. Army Research Institute Field Unit.

Doherty, W. J. & Atwood, N. K. (1987, March). Commander survivability at the National Training Center (ARI Special Report 88-06). Alexandria, VA: U.S. Army Research Institute.

Utilization

Results generated under this task received wide distribution throughout CATA and, in the case of "Commander Survivability", throughout the Army. The results from the latter were distributed to all Division commanders for their consideration. The "Killer Tank" results were provided to both the CATA and CAC commanders. In all three cases, the results were incorporated by CALL into their dissemination system for Army-wide lessons learned.

Task 10

Prepare Proposed Research Plan for Year 3

Summary

As per contract requirement, a research plan was prepared which incorporated Year Two results along with the originally proposed plans for conduct of Year Three.

Products/Reports

Doherty, W. J. (Ed.) (1987, June). Summary of Year Two activities and research plan for Year Three of the contract (ARI Research Note). Presidio of Monterey, CA: U.S. Army Research Institute Field Unit.

CONTRACT YEAR THREE
(Tasks 2A, 11 through 15)

Task 2A (CY Three)

Develop Concepts and Methods for the Measurement and Interpretation of Unit Performance

Summary

The work performed on Task 2A in the final year of the contract was a continuation of the effort started in Task 2 Year One and Task 2A Year Two. The critical task measurement system was developed for fifteen echelon-mission combinations, and the criterion measurement system was further exercised.

Products/Reports

Lewman, T. J., & Root, J. T., Zimmerman, R. A. (1988, August). Critical Task Performance Measurement System (ARI Research Report). Presidio of Monterey, CA: U.S. Army Research Institute Field Unit.

Lewman, T. J., & Root, J. T. (1987, December). Critical Task Performance Measurement System Mission Book - Task Force Defend (ARI Research Note). Presidio of Monterey, CA: U.S. Army Research Institute Field Unit.

Lewman, T. J., & Root, J. T. (1987, December). Critical Task Performance Measurement System Mission Book - Task Force Deliberate Attack Day (ARI Research Note). Presidio of Monterey, CA: U.S. Army Research Institute Field Unit.

Lewman, T. J., & Root, J. T. (1987, December). Critical Task Performance Measurement System Mission Book - Task Force Deliberate Attack Night (ARI Research Note). Presidio of Monterey, CA: U.S. Army Research Institute Field Unit.

Lewman, T. J., & Root, J. T. (1987, December). Critical Task Performance Measurement System Mission Book - Task Force Movement to Contact (ARI Research Note). Presidio of Monterey, CA: U.S. Army Research Institute Field Unit.

Lewman, T. J., & Root, J. T. (1987, December). Critical Task Performance Measurement System Mission Book - Task Force Hasty Attack (ARI Research Note). Presidio of Monterey, CA: U.S. Army Research Institute Field Unit.

Lewman, T. J., & Root, J. T. (1987, December). Critical Task Performance Measurement System Mission Book - Company Team Defend (ARI Research Note). Presidio of Monterey, CA: U.S. Army Research Institute Field Unit.

Lewman, T. J., & Root, J. T. (1987, December). Critical Task Performance Measurement System Mission Book - Company Team Deliberate Attack Day (ARI Research Note). Presidio of Monterey, CA: U.S. Army Research Institute Field Unit.

Lewman, T. J., & Root, J. T. (1987, December). Critical Task Performance Measurement System Mission Book - Company Team Deliberate Attack Night (ARI Research Note). Presidio of Monterey, CA: U.S. Army Research Institute Field Unit.

Lewman, T. J., & Root, J. T. (1987, December). Critical Task Performance Measurement System Mission Book - Company Team Movement to Contact (ARI Research Note). Presidio of Monterey, CA: U.S. Army Research Institute Field Unit.

Lewman, T. J., & Root, J. T. (1987, December). Critical Task Performance Measurement System Mission Book - Company Team Hasty Attack (ARI Research Note). Presidio of Monterey, CA: U.S. Army Research Institute Field Unit.

Lewman, T. J., & Root, J. T. (1987, December). Critical Task Performance Measurement System Mission Book - Platoon Defend (ARI Research Note). Presidio of Monterey, CA: U.S. Army Research Institute Field Unit.

Lewman, T. J., & Root, J. T. (1987, December). Critical Task Performance Measurement System Mission Book - Platoon Deliberate Attack Day (ARI Research Note). Presidio of Monterey, CA: U.S. Army Research Institute Field Unit.

Lewman, T. J., & Root, J. T. (1987, December). Critical Task Performance Measurement System Mission Book - Platoon Deliberate Attack Night (ARI Research Note). Presidio of Monterey, CA: U.S. Army Research Institute Field Unit.

Lewman, T. J., & Root, J. T. (1987, December). Critical Task Performance Measurement System Mission Book - Platoon Movement to Contact (ARI Research Note). Presidio of Monterey, CA: U.S. Army Research Institute Field Unit.

Lewman, T. J., & Root, J. T. (1987, December). Critical Task Performance Measurement System Mission Book - Platoon Hasty Attack (ARI Research Note). Presidio of Monterey, CA: U.S. Army Research Institute Field Unit.

Root, J. T. (November, 1987). Case Study: Functional application of 2A (ARI Working Paper). Presidio of Monterey, CA: U.S. Army Research Institute Field Unit.

Root, J. T. (December, 1987). Extract of Data Sources: Armor Task Force, Deliberate Attack (ARI Working Paper). Presidio of Monterey, CA: U.S. Army Research Institute Field Unit.

Utilization

Task 2A's methodology, models, and procedures (sometimes referred to as the "2A measurement system") are being incorporated into the Army's "how to" training circulars. Training developers use its paradigms as a guide in designing Mission Training Plans. Task 2A's products will be integrated into the National Training Center's measurement system. The methodology is being used to guide development of a similar type system for the Combat Maneuver Training Center in Germany. A modified version of 2A is also being developed for use with the interactive simulator networking system (SIMNET). The Combat Training Centers' data, stored in ARI-POM archives, will eventually be formatted to reflect the 2A structure. This will readily simplify data searches concerning task accomplishment in relation to a specific echelon, operating system, battle phase and mission.

Task 11

Develop an NTC Research Database

Summary

This task had as its major focus the loading of the Mission Database and the design and implementation of the Technical Database. User and operator guides were developed for both databases.

Products/Reports

Briscoe, J. A. (1988, August). Operators' guide to loading the NTC mission database (ARI Research Product). Presidio of Monterey, CA: U.S. Army Research Institute Field Unit.

Baldwin, J. D. (1988, July). Guide to using the ARI-NTC research database (ARI Research Product). Presidio of Monterey, CA: U.S. Army Research Institute Field Unit.

Utilization

The Operators' Guide has been used to introduce operators to the process of building mission databases. The Researchers' guide is included in the NTC database workshops to introduce researchers to the NTC mission databases and to provide basic methods for accessing and using the data.

Task 12

Development of Concepts for Trendline Analyses

Summary

This task continued the work begun under Task 7 in examining methods for improving diagnostic feedback from the NTC. Work involved the development of baselines regarding direct fire weapons and relationships of firing intensity to number of kills.

Products/Reports

Zimmerman, R. A. (1987, September). Trendline analysis of direct fire at the National Training Center (ARI Research Report). Presidio of Monterey, CA: U.S. Army Research Institute Field Unit.

Utilization

BDM's development of trendline analysis methodologies at ARI-POM was used, in part, to produce Lessons Learned material that was disseminated to soldiers training at the NTC through CATA's Lessons Learned publications. Some of the trendline analyses of direct fire at the NTC were incorporated into ARI briefings and have formed the basis for further Army trendline studies. In addition, summary slides on trendline analysis of direct fire were prepared to brief GEN Thurman at the Army Research Board meeting in March 1988.

Task 13

Development of an Integrated Framework for CTC Research

Summary

The anticipated information flow involving NTC, JRTC, CMTC and BCTP data was mapped into a strawman taxonomic structure to be used for generating issues, data organization, and archiving the results. A briefing was prepared and submitted to ARI.

Products/Reports

Zimmerman, D. C. (1988, August). Development of an integrated framework for Combat Training Center (CTC) programmatic research (ARI Research Product). Presidio of Monterey, CA: U.S. Army Research Institute Field Unit.

Utilization

The intended use of this research product is to provide a framework for integrating CTC research. This framework for programmatic research integration was presented to ARI for adoption. The framework incorporates the automated data catalog currently under development at ARI-POM.

Task 14

Support of NTC Lessons Learned

Summary

Analytic support for the CALL Lessons Learned program produced several major reports in response to top priority issues as directed by CALL. The principal effort was concerned with Commander Survivability at the NTC. A methodology for showing battle intensity profiles was developed in support of this effort.

Products/Reports

Zimmerman, D. C. (1988, May). A study of commander survivability at the National Training Center (NTC) (ARI Research Product). Presidio of Monterey, CA: U.S. Army Research Institute Field Unit.

Utilization

This technical report provides brief background information on the importance of commander survival and summarizes the analyses and findings from the study of commander survivability at the NTC. Findings were published in CATA's Lessons Learned (88-1) that featured NTC commander survivability issues. Summary slides comparing and contrasting doctrine and research findings were prepared for the Army Research Board briefing of GEN Thurman in March 1988. In addition, the battle intensity profiles developed for this task were used in NTC Archive Workshops, held at ARI-POM, as analytical tools.

Task 15

Recommend Follow-On Research

Summary

As per agreement with the COR, this contract requirement was satisfied by providing, in this final report, paragraphs describing current and anticipated utilization of products for each contract task.

Products/Reports

Lewman, T. J., (Ed.) (1988, August). Final Report for Contract No. MDA903-85-C-0472 (ARI Researh Note). Presidio of Monterey, CA: U.S. Army Research Institute Field Unit.

Utilization

This report summarizes and documents three years of work in the areas of standardization, structuring, and analysis of NTC data. The report serves as a reference for ARI personnel and others who are working in these areas.